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EXAMINER	
TORRES, JUAN A	

ART UNIT	PAPER NUMBER
2631	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/603,388	HEGDE ET AL.	
	Examiner	Art Unit	
	Juan A. Torres	2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, "forming at least two groups of valid sequences, where each group is formed based on possible initial states" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "100" has been used to designate both "a method of decoding" (see figure 5) and "an eight-sample decoder" (see figure 6).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities: the recitation in lines 8-9 of page 26 "Note that the CPI block shown in FIG. 8 operates first on the most recent observations first (denoted as r(n+2) in FIG. 8)" is improper, because the most recent observations are r(n+7), and they are in Figure 7; it is suggested to be change to "Note that the CPI block shown in FIG. 8 operates first on the most recent observations first (denoted as r(n+7) in FIG. 7)".

Appropriate correction is required.

Claim Objections

Claims 13-15 are objected to because of the following informalities:

As per claim 13, the recitation in lines 10-11 of claim 13 "said selector output, thereby providing an output decision corresponding to the decision information on the interconnected said input" is improperly constructed; it is suggested to be changed to "said selector output, thereby providing an output decision corresponding to the decision information on said interconnected input".

As per claims 14-15, they are objected, because they depend directly from claim 13.

Claim 18 is objected to because of the following informalities: the recitation in line 1 of claim 18 "wherein said a selecting means" is improperly constructed; it is suggested to be changed to "wherein said selecting means".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6,8-9, 11, 25-28 and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen (US 6161210 A).

As per claim 1, Chen discloses forming at least two groups of valid sequences, where each group is formed based on possible initial states (figure 11 block 1100 column 11 line 41 to column 12 line 13); receiving a set of symbol measurements (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); identifying a candidate sequence for each group of valid sequences, where the candidate sequence is a valid sequence from its respective group that is closest to the set of symbol measurements, and where each candidate sequence has corresponding decision information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13); determining at least one output decision by selecting a group and corresponding decision information from the identified candidate sequence in response to candidate sequence selection information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13).

As per claim 2, Chen discloses claim 1, Chen also discloses that each candidate sequence is identified by forming a set of error metrics for each symbol in the set of received symbols, and using the sets of error metrics to select sequences having minimum accumulated errors in time-reverse order (column 1 lines 36-45; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

As per claim 3, Chen discloses claim 1, Chen also discloses that the candidate sequence selection information is fed forward from a prior output decision (figures 4-5;column 6 line 46 to column 7 line 20).

As per claim 4, Chen discloses claim 1, Chen also discloses that the recited steps are performed in each one of a plurality of parallel stages, and where the at least one output decision of each stage is provided to at least one other stage as at least a portion of the candidate sequence selection information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13).

As per claim 6, Chen discloses claim 1, Chen also discloses that the groups are formed according to possible initial states, and where each group corresponds to a single state (figure 11 block 1100 column 11 line 41 to column 12 line 13).

As per claim 8, Chen discloses claim 1, Chen also discloses that the step of determining at least one output decision is performed in response to soft information (column 4 lines 38-57).

As per claim 9, Chen discloses forming groups of paths through a trellis based on the initial states of the paths (figure 11 block 1100 column 11 line 41 to column 12 line 13); forming sets of sequential samples of symbols, where the sets comprise at least a

first set of samples and a next set of samples (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); for each set of samples, determining a plurality of minimum error paths and corresponding candidate decision information, where each group has a minimum error path and corresponding candidate decision information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13); selecting a group corresponding to the first set of samples and its minimum error path and its corresponding decision information, where the selection is based on prior state information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13); using at least a portion of the selected corresponding decision information to select a group corresponding to the next set of samples and its corresponding decision information (figures 4-5;column 6 line 46 to column 7 line 20).

As per claim 11, Chen discloses claim 9, Chen also discloses that each group corresponds to a single possible prior state (figure 11 block 1100 column 11 line 41 to column 12 line 13)

As per claim 25, Chen discloses identifying a candidate sequence for each initial state of a system having a plurality of initial states, where each candidate sequence has an associated candidate set of decision information (figure 11 block 1100 column 11 line 41 to column 12 line 13); receiving initial state decision information (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); and selecting a single candidate set of decision information from the candidate sets in response to the received initial state

information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13).

As per claim 26, Chen discloses claim 25, Chen also discloses that the candidate sequence for each initial state is identified in time-reverse order (column 1 lines 36-45; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

As per claim 27, Chen discloses claim 25, Chen also discloses that he candidate set of decision information comprises at least one data bit decision (figure 8 column 9 lines 52-65).

As per claim 28, Chen discloses claim 25, Chen also discloses that the candidate set of decision information further comprises soft decision information (column 4 lines 38-57).

As per claim 30, Chen discloses claim 25, Chen also discloses computing branch error metrics (figure 4 column 6 lines 7-24); computing and comparing path metrics (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); identifying a path having the smallest path metric for each initial state (figure 11 block 1100 column 11 line 41 to column 12 line 13).

Claims 13-22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu ("Algorithm-based low-power and high-performance multimedia signal processing", Proceedings of the IEEE, Volume 86, Issue 6, June 1998 Page(s): 1155 - 1202).

As per claim 13, Liu discloses at least one sequence error estimator comprising an input to receive symbol error metrics and a plurality of candidate path outputs, where

the at least one sequence error estimator identifies a plurality of candidate paths and decision information corresponding to each of the candidate paths, and provides the decision information at the candidate path outputs; a selector connected to the at least one sequence error estimator, the selector having inputs connected to the candidate path outputs (section IV.B figures 31 and 32 pages 1186-1187); and a selector output for providing an output decision, and a selection input for determining which of the inputs is interconnected to the selector output, thereby providing an output decision corresponding to the decision information on the interconnected the input (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 14, Liu discloses claim 13, Liu also discloses that the at least one sequence error estimator comprises a plurality of sequence error estimators, and where at least a portion of the output decision of a first of the plurality of sequence error estimators is provided to the selection input of another of the plurality of sequence error estimators (section IV.B figure 32 pages 1186-1187).

As per claim 15, Liu discloses claim 13, Liu also discloses that the sequence error estimator comprises a plurality of interconnected selectors and adders where candidate paths are identified in time reverse order (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 16, Liu discloses a branch error metric block for generating incremental error estimates (section IV.B figures 31 and 32 page 1186 BMU); a plurality of candidate path identification blocks, each of the candidate path identification blocks providing a set of outputs (section IV.B figures 31 and 32 pages 1186-1187); a plurality

of selection devices, where each one of the plurality of selection devices is connected to the set of outputs of each one of the plurality of candidate path identification blocks, where each selection device provides data outputs, and where the data outputs of each of the plurality of selection devices is used to select the data outputs of another of the plurality of selection devices (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 17, Liu discloses means for generating branch error metric values (section IV.B figures 31 and 32 page 1186 BMU); at least one decoding means connected to the means for generating branch error metrics, where each decoding means comprises a sequence identification means for identifying a set of candidate sequences in response to the branch error metrics, where each candidate sequence within the set of candidate sequences has associated candidate decision information (section IV.B figures 31 and 32 pages 1186-1187); and a selecting means for receiving the associated candidate decision information, and for providing output decision information, the output decision information being generated in response to the associated candidate decision information, and output decision information from a selecting means of another decoding means (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 18, Liu discloses claim 17, Liu also discloses that the selecting means uses the output decision information from a selecting means of another decoding means to select candidate decision information from one of the candidate sequences (section IV.B figure 32 pages 1186-1187).

As per claim 19, Liu discloses claim 17, Liu also discloses that the sequence identification means computes candidate sequences by operating in a time reverse order (section IV.B pages 1186-1187).

As per claim 20, Liu discloses claim 17, Liu also discloses that the sequence identification means comprises a plurality of min-select means (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 21, Liu discloses claim 17, Liu also discloses that the selecting means is a multiplexer (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 22, Liu discloses claim 17, Liu also discloses that the output decision information includes candidate decision information from one candidate sequence within the set of candidate sequences (section IV.B pages 1186-1187 survivor memory unit).

As per claim 24, Liu discloses claim 17, Liu also discloses that the decoding means comprises a first and a last decoding means, and where the output decision information of the last decoding means is buffered for a first time frame and then provided to the last decoding means in another time frame (section IV.B pages 1186-1187 survivor memory unit).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu as applied to claim 17 above, and further in view of Raghupathy ("A transformation for computational latency reduction in turbo-MAP decoding", Proceedings of the 1999 IEEE International Symposium on Circuits and Systems, 1999, ISCAS '99, Volume 4, 30 May-2 June 1999 Page(s): 402 - 405 vol.4). Liu discloses claim 17. Liu doesn't specifically disclose that the output decision information includes soft decision information. Raghupathy discloses that the output decision information includes soft decision information (abstract and introduction). Raghupathy and Liu are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the soft decision information disclosed by Raghupathy with the Viterbi algorithm disclosed by Liu. The suggestion/motivation for doing so would have been to reduce the complexity of a turbo decoder by using the Soft-Output-Viterbi-Algorithm in a iterative decoder for turbo decoding (Raghupathy and Liu abstract and introduction). Therefore, it would have been obvious to combine Raghupathy with Liu to obtain the invention as specified in claim 23.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as applied to claim 28 above, and further in view of Raghupathy ("A transformation for computational latency reduction in turbo-MAP decoding", Proceedings of the 1999 IEEE International Symposium on Circuits and Systems, 1999, ISCAS '99, Volume 4, 30 May-2 June 1999 Page(s): 402 - 405 vol.4). Chen discloses claim 28. Chen doesn't specifically disclose that the soft decision information comprises a measure of reliability of the at least one data bit decision. Raghupathy discloses that the soft decision

information comprises a measure of reliability of the at least one data bit decision (page 402 section 2 FPM and BPM and Log likelihood ratio). Raghupathy and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the reliability metric disclosed by Raghupathy with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to reduce the complexity of a turbo decoder by using the Soft-Output-Viterbi-Algorithm in a iterative decoder for turbo decoding (Raghupathy and Liu abstract and introduction). Therefore, it would have been obvious to combine Raghupathy with Chen to obtain the invention as specified in claim 29.

Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as applied to claims 4 and 9 above, and further in view of Tsui (US 6070263 A).

As per claim 5, Chen discloses claim 4. Chen doesn't specifically disclose that the respective sets of received symbols for the plurality of stages are overlapping. Tsui discloses that the respective sets of received symbols for the plurality of stages are overlapping (abstract, figure 4 column 3 line 62 to column 4 line 59 sa and sb are input to compute Ms0 and Ms1). Tsui and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the overlapping states disclosed by Tsui with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to reduce the power consumption (Tsui abstract and column 3 lines

62-66). Therefore, it would have been obvious to combine Tsui with Chen to obtain the invention as specified in claim 5.

As per claim 10, Chen discloses claim 9. Chen doesn't specifically disclose that a portion of the sequential samples in the first set of sequential samples is repeated in a portion of the sequential samples in the next set of sequential samples. Tsui discloses that a portion of the sequential samples in the first set of sequential samples is repeated in a portion of the sequential samples in the next set of sequential samples (abstract, figure 4 column 3 line 62 to column 4 line 59 sa and sb are input to compute Ms0 and Ms1). Tsui and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the overlapping states disclosed by Tsui with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to reduce the power consumption (Tsui abstract and column 3 lines 62-66). Therefore, it would have been obvious to combine Tsui with Chen to obtain the invention as specified in claim 10.

Claims 7 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as applied to claims 4 and 9 above, and further in view of Boo ("High-performance VLSI architecture for the Viterbi algorithm", IEEE Transactions on Communications, Volume 45, Issue 2, Feb. 1997 Page(s): 168 - 176).

As per claim 7, Chen discloses claim 1. Chen discloses that the groups are formed according to possible initial states. Chen doesn't specifically disclose that each group corresponds to a plurality of initial states. Boo discloses that each group

corresponds to a plurality of initial states (abstract, figures 1, 2 and 4b pages 169-172, PE0 and PE1). Boo and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the grouping using a plurality of initial states disclosed by Boo with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to improve the performance of the Viterbi algorithm (Boo title, abstract and pages 169-172). Therefore, it would have been obvious to combine Boo with Chen to obtain the invention as specified in claim 7.

As per claim 12, Chen discloses claim 9. Chen doesn't specifically disclose that each group corresponds to a plurality of initial states. Boo discloses that each group corresponds to a plurality of initial states (abstract, figures 1, 2 and 4b pages 169-172, PE0 and PE1). Boo and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the grouping using a plurality of initial states disclosed by Boo with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to improve the performance of the Viterbi algorithm (Boo title, abstract and pages 169-172). Therefore, it would have been obvious to combine Boo with Chen to obtain the invention as specified in claim 12.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Forney, G.D., Jr. ("The Viterbi algorithm" Proceedings of the

IEEE Volume 61, Issue 3, March 1973 Page(s): 268 – 278) discloses a Viterbi algorithm using groups of initial states (section III pages 271-273 figure 10).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Juan A. Torres whose telephone number is (571) 272-3119. The examiner can normally be reached on Monday-Friday 9:00 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay K. Patel can be reached on (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Juan Alberto Torres
03-06-2006

TEMESGHEN GHEBRETINSAE
PRIMARY EXAMINER
3/7/06